NON-TRADITIONAL, NON-VOLATILE MEMORY BASED ON SWITCHING AND RETENTION PHENOMENA IN THIN FILMS

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Abstract

During the last few years significant efforts have been under taken in the search to understand the physical principles and to realize and implement the “universal memory”, that is the type of memory which would combine high-speed recording and erasing (dynamic memory) and long retention time (non-volatile memory).

The ideal memory cell is a two terminal device, which consists of two electrodes with the active layer(s) placed between them. The material of the active layer must change its resistance dependent on the magnitude and polarity of the applied electric field and also retain this resistance value after the removal of the electric field.

There are many published reports on the effects of switching and memory in various thin film systems such as: inorganic and organic dielectrics, various inorganic and organic semi-conductive materials, polymeric materials, etc. In this paper, special attention is focused on the physical properties of conjugated polymers and related materials, because the effects of switching and memory are most often observed and are most applicable to memory devices in these materials. A significant portion is devoted to the properties of superionic materials, with emphasis on electrical drift, solid-state ionic mobility, and ionic injection and doping since these phenomena, present in the active layer region, are most often responsible for the observed, thin film switching mechanisms.

The conclusion will provide a recommendation on materials systems with potential for “universal memory” devices.